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ON THE IDENTITY OF TWO EASTERN NORTH AMERICAN *HYDRIOMENA* SPECIES (LEPIDOPTERA, GEOMETRIDAE)

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As a preliminary to an anticipated revision of the eastern North American species of the geometrid genus *Hydriomena*, the following article deals with the identity of two species, the determination of which has been a constant source of worry to recent taxonomists, viz., *pluviata* Guenée and *frigidata* Walker. The causes of this are partly to be found in the inadequate descriptions by earlier authors who, at the time, did not realize the close similarity of several of our North American species in both color and maculation, and partly in the inaccessibility of the type material to workers in this country, the type of *frigidata* being in the British Museum (Natural History), London, and that of *pluviata*, first in the Guenée collection at Paris and later in the Oberthür collection at Rennes, France. There was, further, the idea, promulgated by Hulst in Dyar's "Catalogue" of 1902, that all the names based on American species were synonyms of the European *autumnalis*. Not until the various papers by Swett in the Canadian Entomologist (1911-1915), and more especially the revision by Barnes and McDunnough in 1917 (Contributions to the natural history of the Lepidoptera of North America, vol. 4, no. 1), when for the first time characters of the male genitalia were used to differentiate species, was the complex nature of the genus made evident. Even to these authors who definitely established the identity of American species, showing them to be distinct from European ones, was the determination of the above two species a mooted point.

The present investigation has been greatly assisted through the

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courtesy and efforts of Mr. D. S. Fletcher of the British Museum (Natural History). Not only was it possible to have specimens carefully compared with the type of *frigidata*, but a slide of the genitalia was made available for study. Through Drs. T. N. Freeman and E. Munroe much material in the Canadian National Collection, Ottawa, was obtained on loan. Dr. Frederick H. Rindge forwarded for study all relevant specimens in the collection of the American Museum of Natural History, and Mr. J. G. Franclemont was permitted, through the courtesy of the United States National Museum authorities, to send on the material in this collection, including the type of *pluviata*. This had been purchased by Barnes on the death of Oberthür along with other Gue­née types and later, again by purchase, became the property of the museum. Further material was lent by Messrs. L. R. Rupert of Sardinia, New York, J. L. Sperry of Riverside, California, and O. Buchholz of Roselle Park, New Jersey. Through the cooperation of Drs. F. H. Rindge, and J. Bequaert of the Museum of Comparative Zoölogy, Cambridge, Massachusetts, it was possible to secure the abdomen of the holotype of *transfigurata* Swett from which to make a genitalic slide. To all these gentlemen the author's sincere thanks are due.

Hydriomena frigidata Walker

For some time the author has felt that the determination of this species in the Barnes and McDunnough revision (*op. cit.*, p. 17, pl. 3, figs. 12–14; pl. 8, fig. 5) was incorrect. This determination was based on specimens from the eastern and middle United States, whereas the type of the species was a male, collected by Lieutenant Redman in Nova Scotia. No definite locality was given by Walker, but the specimen was very probably collected in the vicinity of Halifax where Redman may have been stationed. In the various collections sent for study and also among the material in the Nova Scotia Museum of Science, Halifax, which, owing largely to the efforts of Mr. D. C. Ferguson, contains a very representative collection of Halifax species, nothing could be found that at all matched the conception of the species given in the revision. Correspondence with D. S. Fletcher of the British Museum (Natural History) ensued, and by this means it was possible not only to match Walker's type practically exactly, but also to secure the opportunity of personally studying an excellent slide of the male genitalia made by Fletcher. A single male in the

collection of the American Museum of Natural History, taken by J. Perrin on MacNab's Island (an island in Halifax harbor) on June 18, 1907, was found to be almost the exact counterpart of Walker's type; this specimen is figured (fig. 1A). It might be

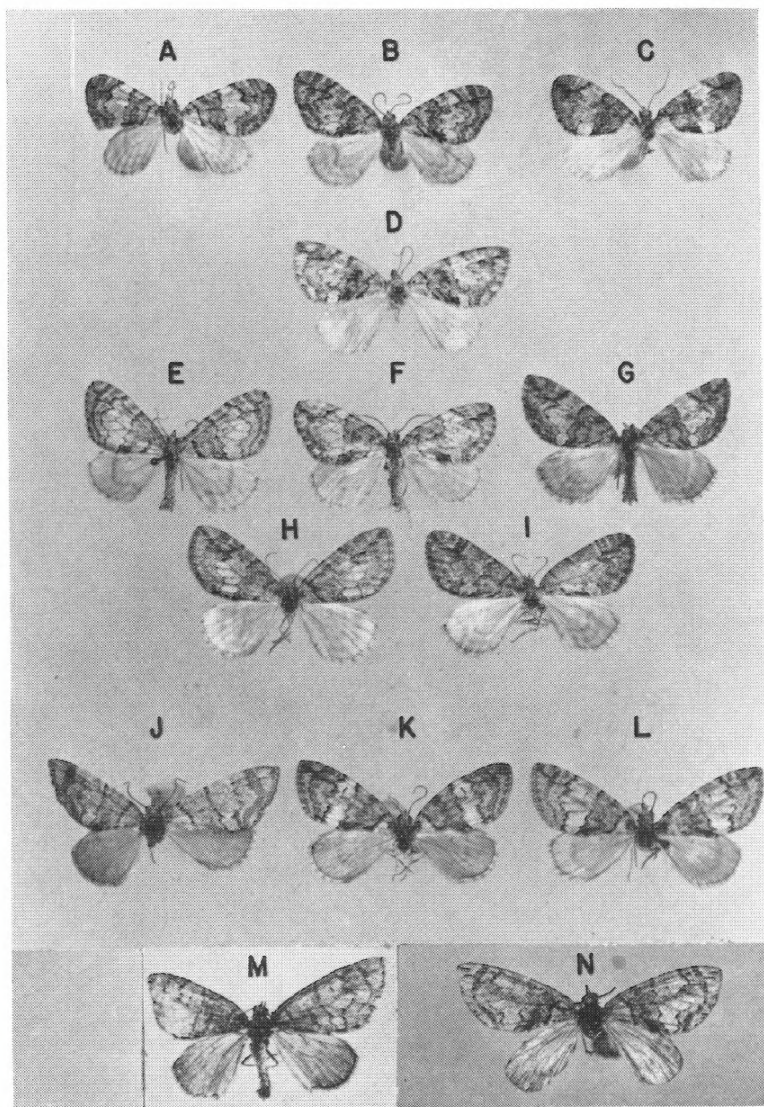


FIG. 1. A-D. *Hydrionema frigidata* Walker. E-I. *H. divisaria* Walker. J. *H. pluviata* Guenée, variety. K-L. *H. manitoba* Barnes and McDunnough. M. *H. transfigurata* Swett, holotype. N. *H. pluviata* Guenée, holotype.

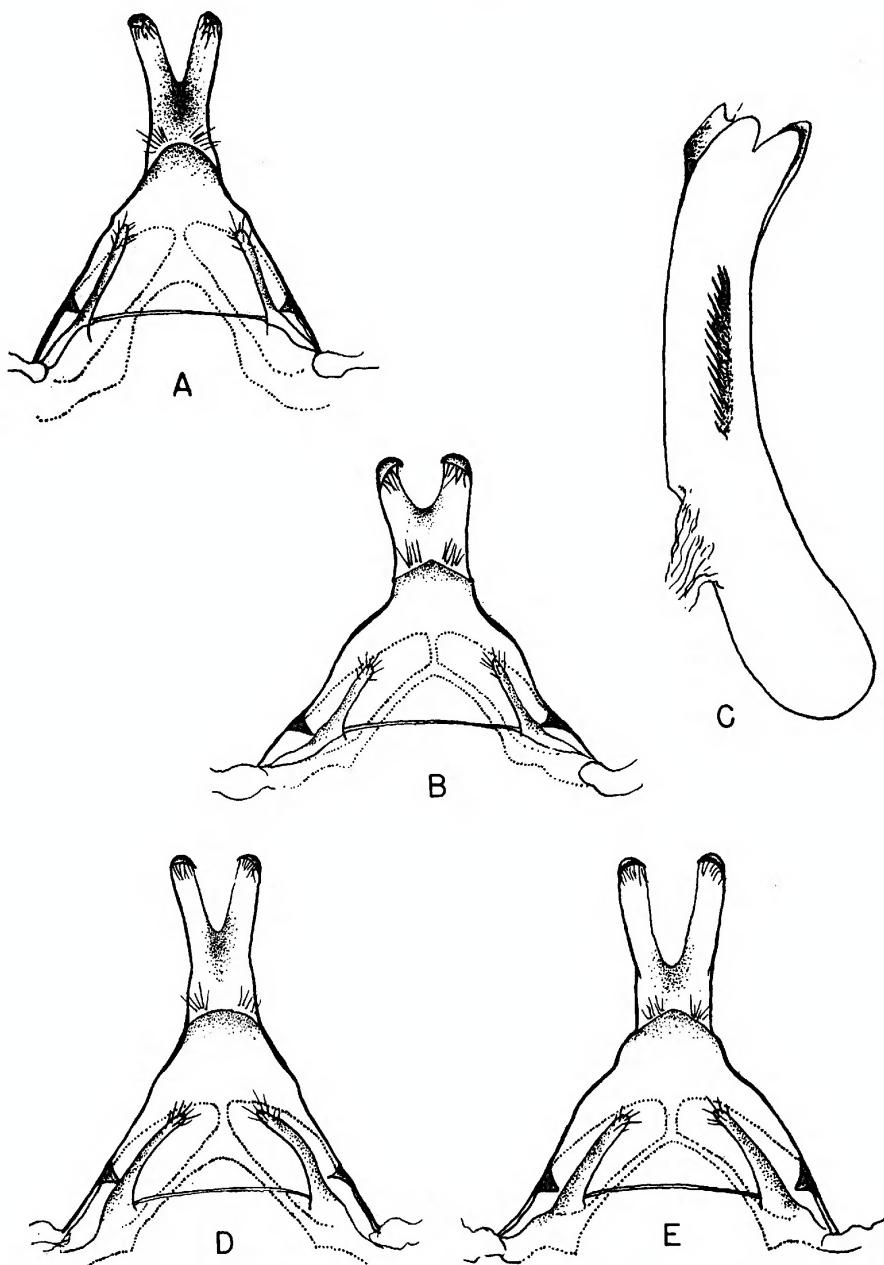


FIG. 2. A. Uncus of *Hydriomena divisaria* Walker (Brome Lake, Quebec). B. *H. frigidata* Walker, holotype. D. *H. frigidata* Walker, variant (MacNab's Island, Nova Scotia). E. *H. frigidata* Walker, variant (South Milford, Nova Scotia). C. Aedeagus of *H. frigidata* Walker, holotype.

well to state that Perrin was one of the older collectors in the Halifax area; he lived on the island, which belonged at that time to his family, and made extensive collections there during the first two or three decades of this century, distributing his material freely to various collectors of that era. The balance of his collection is now in the Nova Scotia Museum of Science.

The following descriptive notes are based on this specimen: The species is a small one, with palpi of moderate length, comparable in both respects to *divisaria* Walker (this name in the revision was erroneously listed as a synonym of *pluviata* but later revived). On the primaries the basal area is dull whitish, with a distinct,

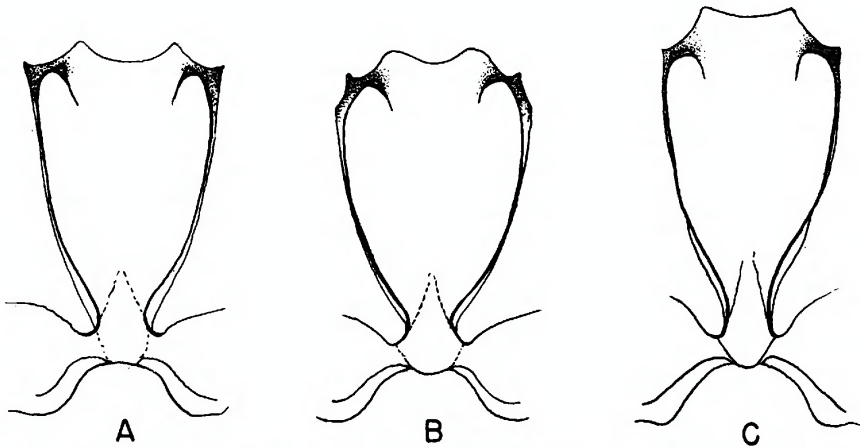


FIG. 3. A. Juxta plates of *Hydryomena divisaria* Walker (Brome Lake, Quebec). B. *H. frigidata* Walker, holotype. C. *H. frigidata* Walker, variant (MacNab's Island, Nova Scotia).

small, black spot below costa; this area is defined outwardly by a distinct, oblique, black line, with a slight outward angle on cubitus. The broad antemedian band is dark, shaded with ruddy and crossed by the usual irregular band of a dark color which ends in a slight blackish suffusion on the inner margin; its outer area is bordered by a blackish crenulate line, slightly less outwardly oblique than the subbasal line. The median space is prominently dull whitish, tinged slightly with ruddy, especially above the inner margin. Its outer margin is formed by a distinct black line, heavier in the costal half of wing; this line shows the usual indentation in the cell and the prominent outward bulge below same; it is upright above the inner margin, feebly crenulate, and

closely approached to the line bordering the preceding dark area; there is no discal spot. The subterminal and terminal areas are noticeably suffused with ruddy and crossed by the usual bluish black curved band, rather broad below costa and narrowing towards inner margin. The usual two subapical, black, transverse streaks are present but not very strongly defined. The fringes are slightly checkered. The secondaries are light smoky crossed by an angled, darker, postmedian line and a diffuse, subterminal, narrow band. It is interesting to note that this specimen had evidently been examined by me at the time of the 1917 revision and bears my label, "Form of *H. pluviata* which may be a good race."

In the material examined no other specimen was found which matched the MacNab's Island one particularly closely. Not only is the species apparently rather rare, but it is evidently, as are so many *Hydriomena*, subject to considerable variation. The following additional Nova Scotia specimens in the material examined are considered as belonging to the species: one male, Armdale (a suburb of Halifax), June 22, 1947 (D. C. Ferguson), in the Nova Scotia Museum of Science; one male, Annapolis Royal, June 12, 1949 (D. C. Ferguson), in the same collection; one male, Digby, June 24, 1907 (J. Russell), in the American Museum of Natural History; two males, South Milford, June 19 and 26, 1934 (J. McDunnough), in the Canadian National Collection; one male, Barrington Passage, June 19, 1910 (C. H. Young), in the same collection along with one male, Baddeck, June 23, 1936 (J. McDunnough); and, finally, a single rather worn female in the Canadian National Collection from MacNab's Island, July 21, 1914 (J. Perrin).

The Armdale specimen is figured (fig. 1B) as well as the later capture at South Milford (fig. 1C); they represent, to the author's mind, degrees of variation from the typical form. The female is also figured (fig. 1D) and is a close match to the Armdale male.

As regards the male genitalia the type of clasper with its armature is so similar throughout the species of the genus as to offer little in the way of tangible specific characters. The main differentiating features are found in the uncus, the juxta plate, and to a certain extent in the aedeagus. The present species can at once be separated from the false *frigidata* of the revision by the presence of a rather indistinct cluster of fine spines in the vesica, rather loosely connected. Similar spine patches occur in *divisaria* and *renunciata* but are not to be found in the *frigidata* of

Barnes and McDunnough (*nec* Walker). A figure is given of the uncus and adjacent parts of the actual type of *frigidata* (fig. 2B and C), and a comparison with that of *divisaria*, as figured in the revision (pl. 9, fig. 1), shows how closely the two correspond. There appears, however, to be considerable variation in the width of the uncus neck and the depth of the excavation between the forks. A slide of the genitalia of the MacNab's Island specimen, already referred to (fig. 2D), which matches the type so closely in color and maculation, shows a much narrower and slightly longer neck as well as a more V-shaped excavation. This excavation is still longer (fig. 2E) in the South Milford specimen figured, and drawings of both from slides made from these specimens are presented. The same type of variation is found in *divisaria*, the uncus of a specimen from Brome Lake, Quebec, being figured (fig. 2A) for comparison with the figure given in the revision. As regards the juxta plate, the only difference at all obvious between that of the type (fig. 3B) and other specimens (fig. 3C) is a slight increase in the width of the former; the plate of *divisaria* (fig. 3A) is also closely similar.

The female genitalia, as far as can be determined from the single specimen available (MacNab's Island), are quite normal for the genus in general character. The ductus bursae is broad and rather short, and the partial septum terminates in a large hollow spine. The single digitabulum is situated proximally on the left side of the membranous bursa and shows on both its ventral and dorsal basal edges single spines, situated more or less medially, and approximately equal in size but much smaller than the one terminating the septum. The position and shape of the digitabulum will probably be found to vary to a certain degree according to the inflation of the bursa and the position of the object on the slide, and such differences cannot be said to have specific value. The dorsal attachment of the bursa to the ductus is well rounded and situated close to the distal end of same. An illustration is given (fig. 4B) of this organ from the specimen figured (fig. 1D) and also one of the same organ in *divisaria* (fig. 4A), made from a practically topotypical specimen (fig. 1H) from Kazubazua, Quebec, a small village in the Laurentian Mountains, probably not more than 50 miles, as the crow flies, west of the locality on the Rouge River where D'Urban collected the type male, now in the Canadian National Collection. The close similarity of both figures can be readily noted.

Summing up, it would appear that the true *frigidata* is very closely allied to *divisaria* and is mainly distinguished by the ruddy shading on the primaries which is not found in typical *divisaria* with its even, gray coloration. It could readily prove to be merely a race of the latter occurring in the southern portion of Nova Scotia. The small series available for study from Baddeck, Cape Breton Island, seems to intergrade between both forms, while the few specimens examined from New Brunswick tend more towards *divisaria*. Several specimens of *divisaria* from the Canadian National Collection are figured for comparison. Figure 1E and H represent a topotypical pair from Kazubazua, Quebec; figure 1F represents a male from Shediac, New Brunswick; figure 1G, a male from Onah, Manitoba; and figure 1I, a female from Baddeck, Nova Scotia. For the present, pending the examination of more material and a knowledge of the early stages of *frigidata* (*divisaria* larva is a feeder on conifers), it would appear wise to keep the two names separate.

For the false *frigidata* of the revision, the name *manitoba* Barnes and McDunnough appears applicable; this name was originally proposed for a so-called race from Manitoba, but the characters given appear to have little value subspecifically. Specimens from Brandon, Manitoba, and Horseheads, New York, are figured (fig. 1K and 1L, respectively).

Hydriomena pluviata Guenée

Described from three variable specimens, with the locality given merely as "Amérique septentrionale," the correct identity has always been a "bugbear" to taxonomists. One variety, which was mentioned by Guenée as having a rosy suffusion, is presumably, if still existing, in the National Museum at Paris; this was considered by Swett to be the same as his later-described *perfracta* (1910, Canadian Ent., vol. 42, p. 279). The other two specimens came through Guenée's collection into that of Oberthür and later, by way of the Barnes collection, to the United States National Museum at Washington. The various nomenclatorial vicissitudes through which the species had passed were well summed up by Barnes and Benjamin (1928, Pan-Pacific Ent., vol. 4, p. 134). They arrived at the conclusion, after a study of the male lectotype to which the name had been restricted (1922, Ent. News, vol. 33, p. 229), and a comparison with a male paratype of *transfigurata* Swett from Cohasset, Massachusetts, which came from the

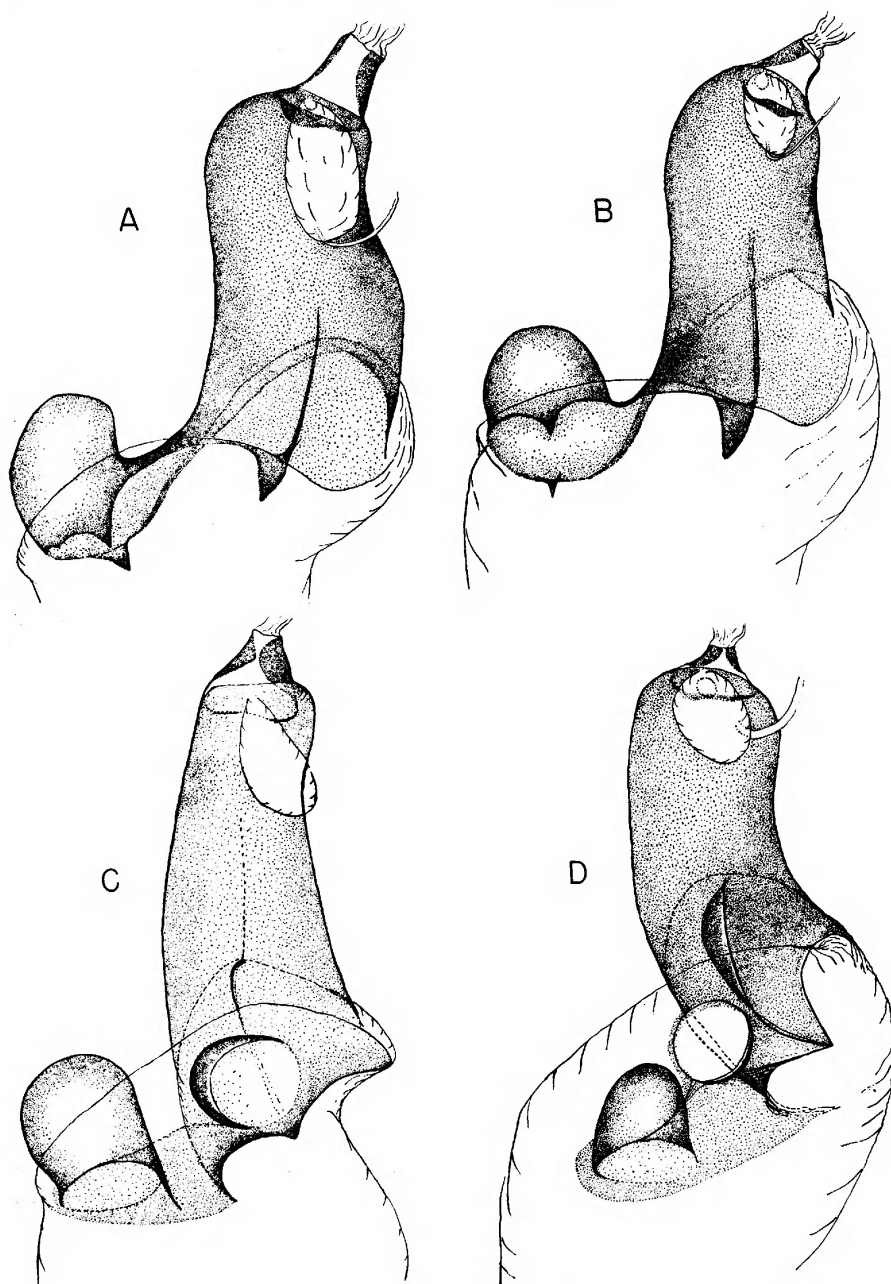


FIG. 4. Female genitalia. A. *Hydryomena divisaria* Walker (Kazubazua, Quebec). B. *H. frigidata* Walker (MacNab's Island, Nova Scotia). C. *H. pluviata* Guenée, old specimen, unlabeled, in United States National Museum. D. *H. manitoba* Barnes and McDunnough (Horseheads, New York).

Barnes collection and was figured in the revision (pl. 3, fig. 15), that *transfigurata* should become a synonym of *pluviata*. This synonymy was followed in the 1938 check list.

The receipt of the above two specimens afforded an opportunity to test the accuracy of this conclusion and, on comparison of the two genitalic slides, the close similarity of these organs was at once obvious. Not only did they agree in the shape of the uncus with its laterobasal small tubercles, but also (a most important factor) in the contour of their juxta plates. The synonymy, therefore, seemed to be established. In the meantime, through the cooperation of Dr. J. Bequaert, curator of the entomological collections of the Museum of Comparative Zoölogy at Cambridge, Massachusetts, the body of the male type of *transfigurata* from Forest Hills, Massachusetts, had been received for the purpose of making a genitalic slide. This preparation most unfortunately proved to be quite dissimilar from that of the afore-mentioned paratype; not only were the laterobasal tubercles of the uncus missing, but, more important still, the juxta plate was obviously different. The whole organ appeared suspiciously like that of specimens from Lakehurst, New Jersey, which had been known under the erroneous name of *frigidata*. Figures of the uncus and juxta are given for comparison (fig. 5D and E). At the present time it is not proposed to go further into the specific identity except to state that the name *transfigurata* must be removed from the synonymy of *pluviata*. Apparently two closely similar species, as far as maculation is concerned, occur in the same general area, but much more topotypical material of both sexes must be studied before a correct solution of the problem can be offered.

Figures are given of both Swett's and Guenée's types (fig. 1M and N). Guenée's specimen is very worn and faded, and only traces of what originally was probably an extensive greenish suffusion of the primaries remain. In size and in the shape and direction of the transverse lines and bands it matches quite closely the paratype of *transfigurata* as already figured. The subbasal line is somewhat heavier, but the direction and the broad obtuse angulation on the cubitus are similar; the strongly evident, dark, subterminal band crossing a pale area (probably originally greenish) is also identical; the secondaries are light smoky. It is unfortunate that among the numerous labels attached to the specimen, indicating the various collections in which it had reposed, there is no mention of the source from which it came. The name

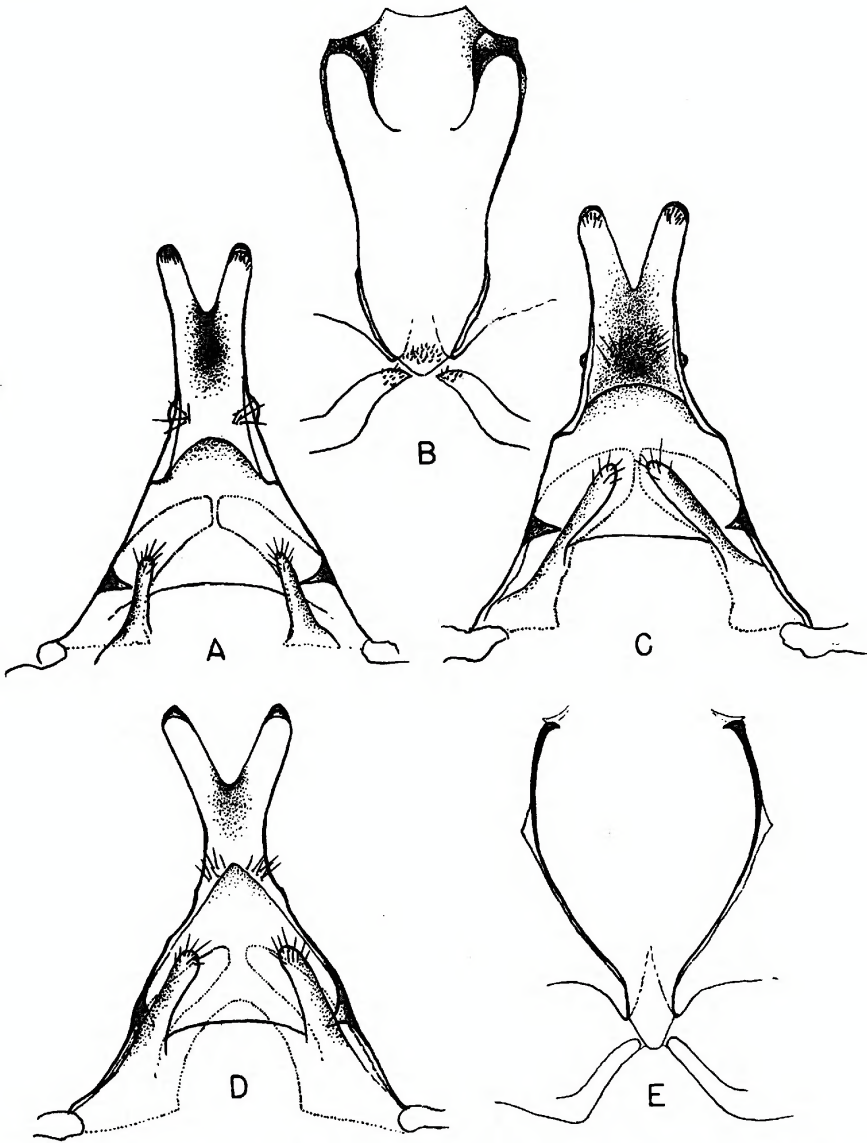


FIG. 5. A. Uncus of *Hydriomena pluviata* Guenée, holotype. B. Juxta plate of same. C. Uncus of *H. pluviata* Guenée, variety (Lakehurst, New Jersey). D. Uncus of *H. transfigurata* Swett, holotype. E. Juxta plate of same.

label, in Guenée's handwriting, also bears the inscription "No. 1505, Boite 375," but that tells us nothing. There is a slim possibility that it was received from Harris or some of the early Massachusetts collectors, but this is mere conjecture.

Among other specimens submitted by the United States National Museum, an old worn female from the Riley collection on a double mount was found. This had either been submitted to Zeller in 1871 or presented by him to Riley, as it bears a label in Zeller's handwriting, "pluviata Gn. Vermag ich nicht daran zu erkennen." There are other labels attached, testifying to the attempts made at identification, and immediately below the specimen is the number "10"; unfortunately no locality label is present. If the specimen came originally from Zeller, the locality could easily have been Massachusetts, as it is known that he received considerable material from this state. The close similarity in coloration and maculation to Guenée's type, as far as the condition of the specimen permits of comparison, suggests that it may be the opposite sex, but a considerable element of doubt still exists in this respect, although the genitalia are distinct from those of any other specimens examined.

In the Sperry collection a male from Lakehurst, New Jersey, taken by Lemmer (May 1-10) and determined as *pluviata* was found; later a series of the same form was received from both O. Buchholz and the Ottawa collection, all collected at Lakehurst in either April or May. It appears that on male genitalic characters this form must be assigned to the *pluviata* group; the uncus neck is somewhat shorter and thicker than that of the type, but the basal tubercles are present, and the juxta plate, which appears to represent the most constant specific character, is similar. This specimen is figured (fig. 1J) as well as the characteristic portion of the genitalia (fig. 5C). The genitalia of the female show, however, well-marked differences from those of the female that has been doubtfully considered as representing this sex of *pluviata* and, in fact, agree with those of the allotype of *transfigurata*, a slide of which was made and compared some time ago by the author. The matter is left for the present in abeyance, pending the study of more material, and will be dealt with in the more complete revision. This Lakehurst form is smaller than typical *pluviata*; the coloration of the primaries is decidedly yellow green, and the lines and bands, particularly the subterminal band, are somewhat heavier. Another worn male was present in the United States

National Museum collection from Raleigh, North Carolina (F. Sherman, Jr.), which probably falls here. The yellowish coloration is much less obvious, being shaded with smoky, and the markings are very heavy. In the genitalia the uncus neck is quite narrow and the basal tubercles are much reduced; the juxta plate, however, agrees quite well. A single female from Clarke County, Georgia, is in the American Museum of Natural History collection, the genitalia of which appear to be very close to those of Lakehurst specimens. In coloration it resembles the North Carolina male, but until adequate material of both sexes from these more southern regions can be secured the problem of identification is a difficult one.

From the type of *pluviata* a drawing of the uncus and adjacent parts, as well as of the juxta plate, is presented (fig. 5A and B). In this latter, attention is called to the greater length and slightly concave lateral edges, as compared with the shorter length and convex margins found in the plates of the *frigidata* complex; the base is broader and shows none of the stalk-like appearance of the other group, owing to its close contact with the basal portion of the sacculus; the apical chitinous projections are very strong. The aedeagus is without the spine patch found in *frigidata*. An illustration is also given of the genitalia of the doubtful female *pluviata* mentioned above (fig. 4C). For comparison the same organ in *manitoba*, drawn from a specimen taken at Horseheads, New York (L. R. Rupert), is added (fig. 4D). The general similarity, with the complicated connection between the two digitabula, is obvious. In *pluviata*, however, the ductus bursae is narrower and longer than that of *manitoba*, considerably less bent distally, and gradually expanding towards the distal end. The septum is much reduced and less twisted. The positions of the digitabula will probably be found to vary when more material is available for examination.

